

Retrospect

A look at what worked and what failed

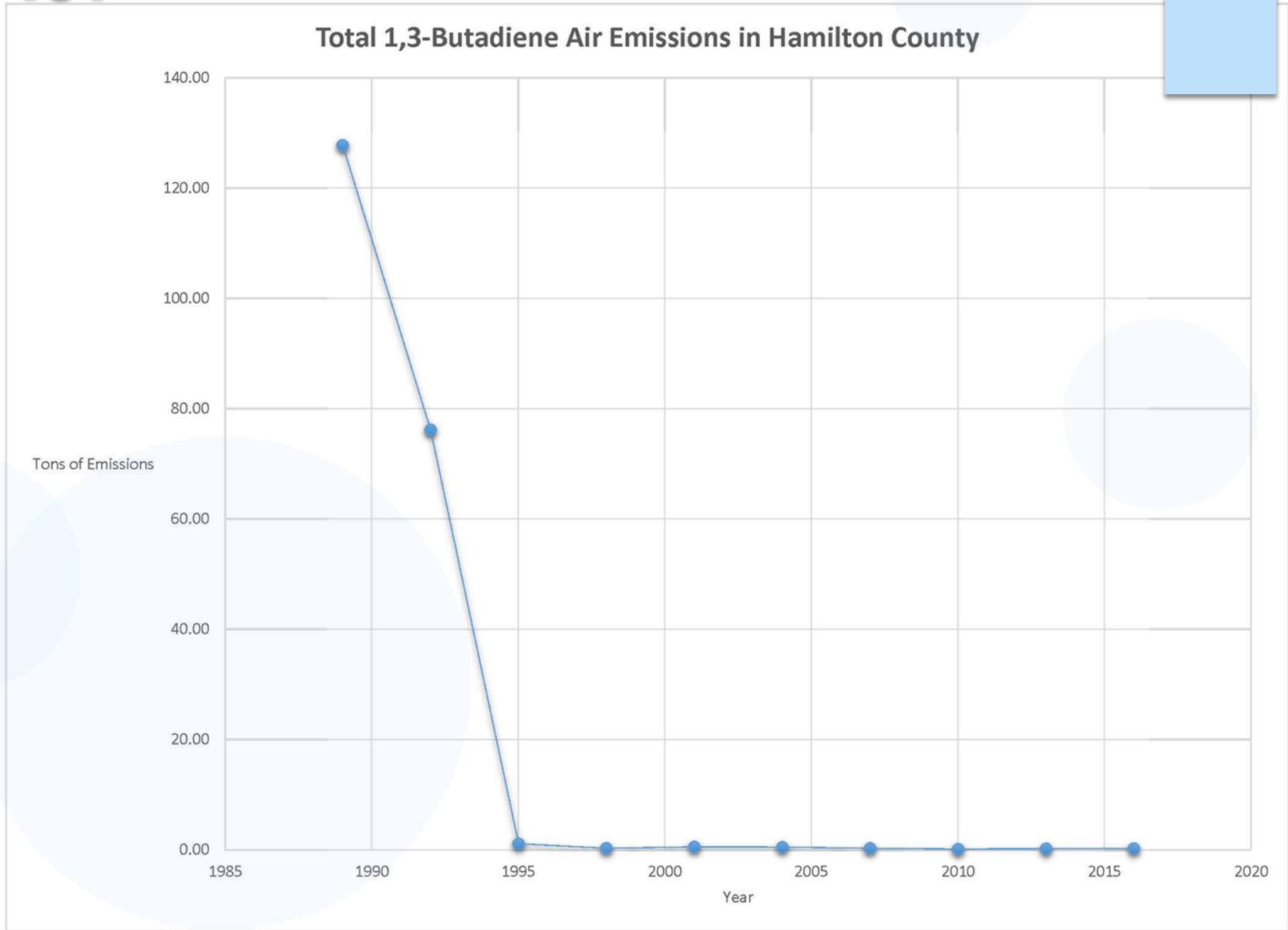
Success – Early Emissions Reductions

BASF Corporation Plants #1 and #2 and Velsicol Chemical Corporation took “**early emissions reductions**” to avoid applicability of 40 CFR 63 Subparts F, G, and H “National Emission Standards for Organic Hazardous Air Pollutants (NESHAP) from Synthetic Organic Chemical Manufacturing Industry” (the HON).

- **BASF**

- Plant #1 installed an enclosed flare in 1991
- Plant #2 installed a thermal oxidizer in 1990 to control emissions of 1,3-butadiene.
- **As a result, 1,3-butadiene emissions were reduced from 127.8 tons in 1989 to 1.3 tons in 1992.**

Total 1,3-Butadiene Air Emissions in Hamilton County



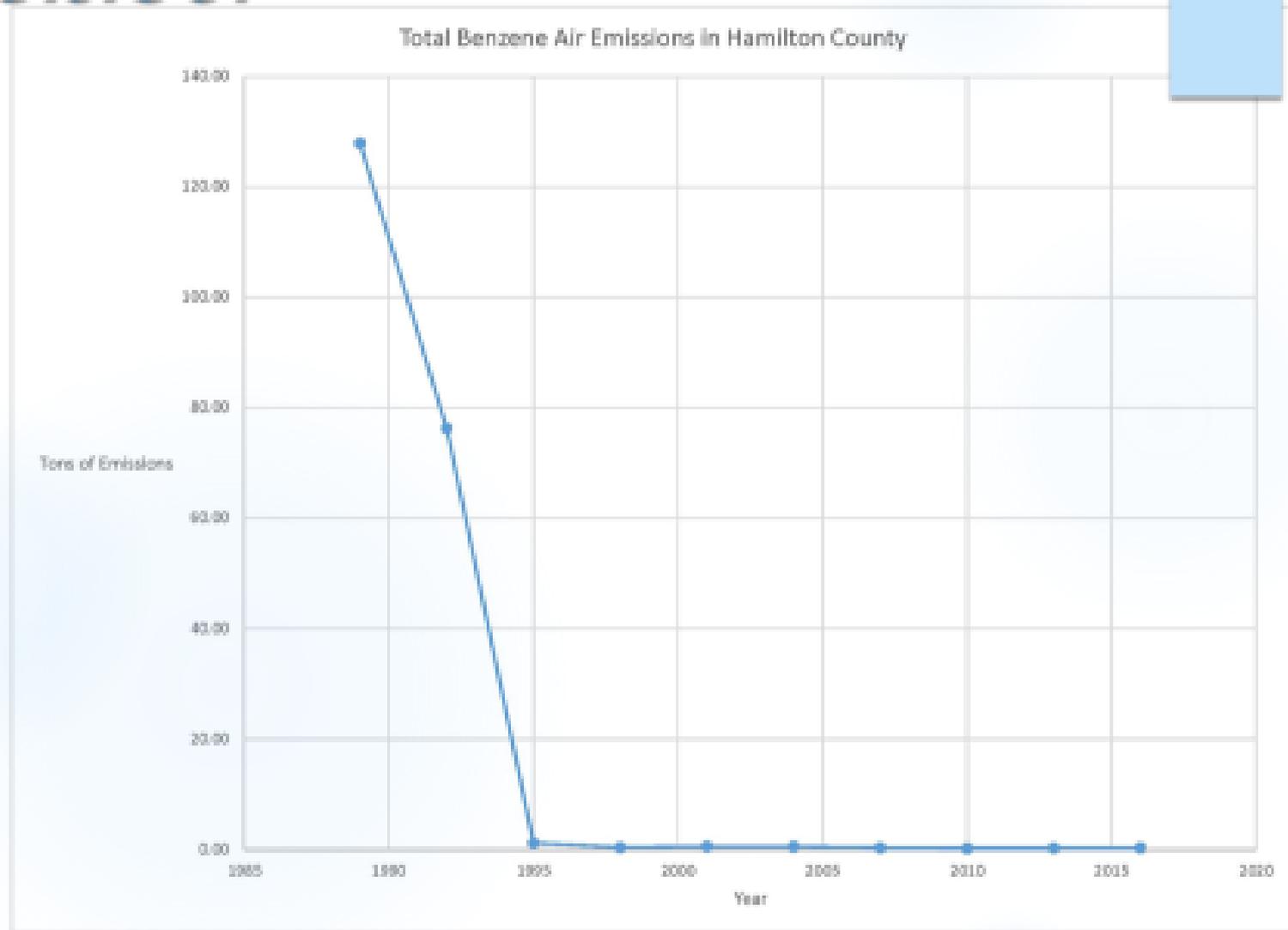
Success – Early Emissions Reductions

Velsicol



- Installed an afterburner in 1991, primarily to control emissions of benzene.
- **As a result, benzene emissions were reduced from 56.4 tons in 1990 to 0.3 ton in 1992.**

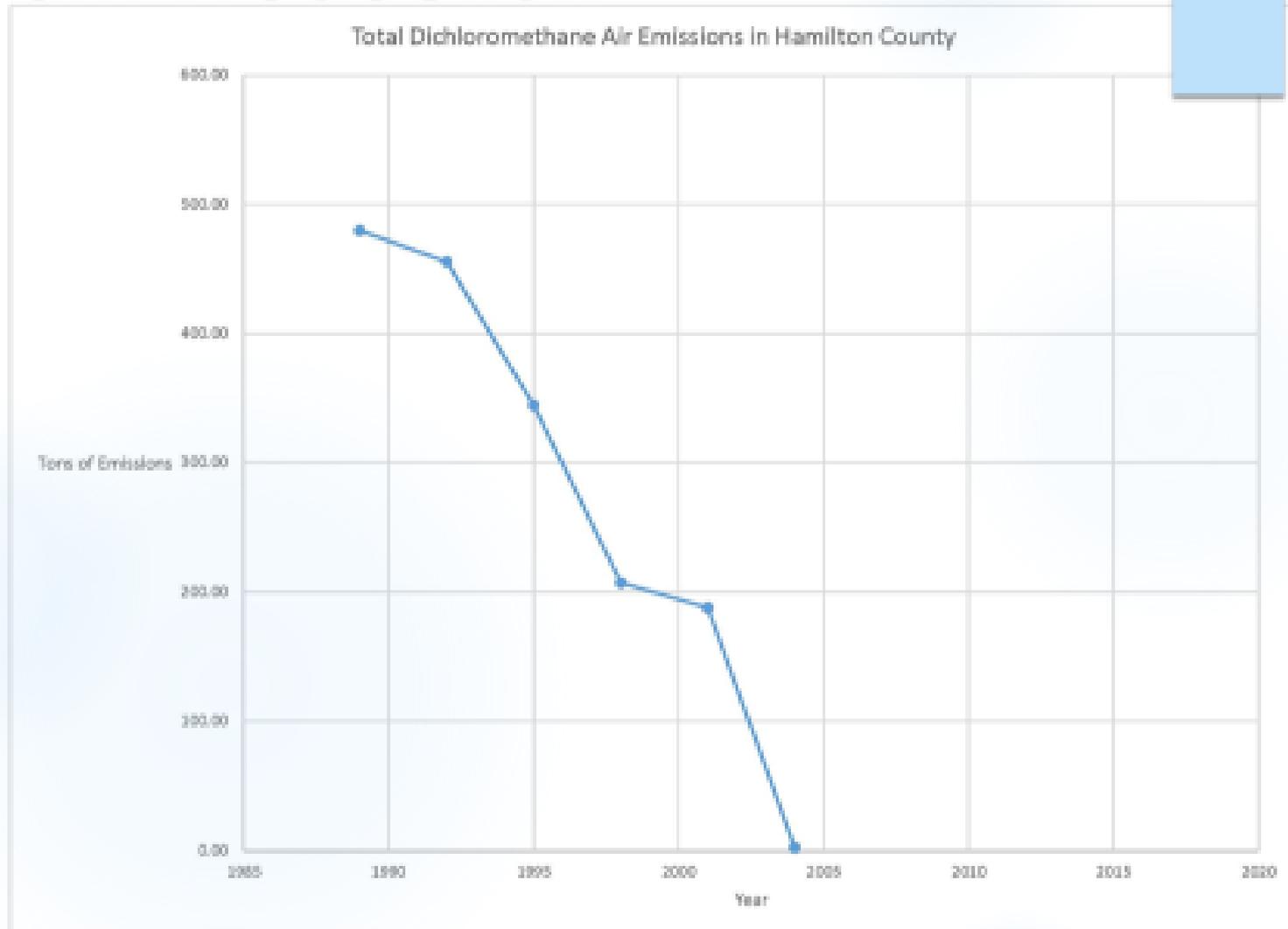
Velsicol



Success – Reduction of Dichloromethane Emissions

- Polyurethane foam manufacturers and fabricators were required by 40 CFR 63 Subpart OOOOOO “National Emission Standards for Hazardous Air Pollutants for Flexible Polyurethane Foam Production and Fabrication Area Sources” to find alternatives to using dichloromethane (methylene chloride) in foam pouring or as a component of foam adhesives.
- **As a result, dichloromethane emissions from foam production and fabrication within Hamilton County, which were 479.5 tons in 1991, were eliminated.**

Foam Production



BURNING CLEANER FUEL

Avoiding applicability of 40 CFR 63 Subpart JJJJJ “National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources”

- 79 permitted boilers in Hamilton County either burn natural gas exclusively, or
- their owners/operators confirmed that distillate (No. 2) fuel oil would only be burned in them during natural gas curtailment

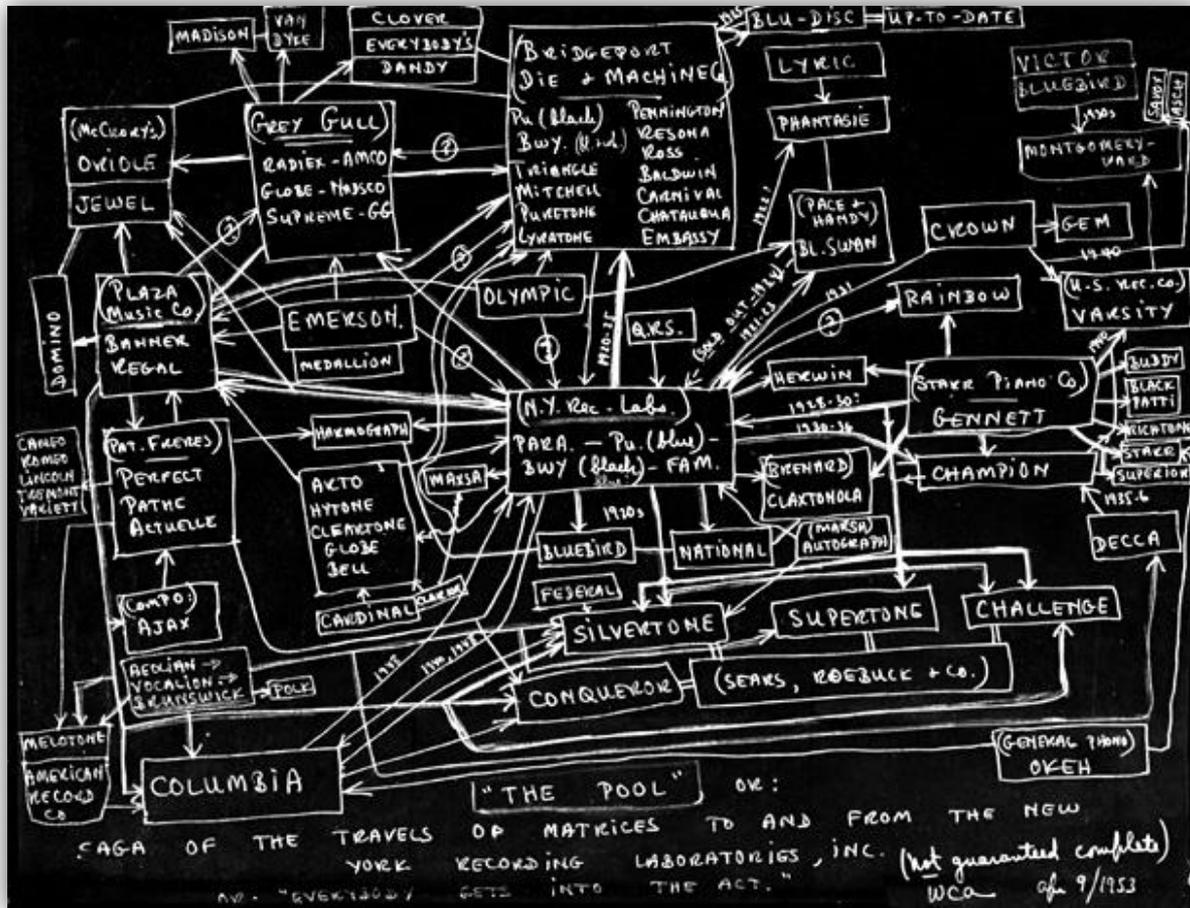


INVISTA CEASES BURNING COAL IN ANY OF THEIR BOILERS IN 2012

- As a result, emissions of sulfur oxides (SOX) were reduced from **732.7 tons** in 2010 to **0.4 ton** in 2013.
- Nitrogen oxides (NOX) were reduced from **265.2 tons** in 2010 to **66.1 tons** in 2013.



Failure – A Convoluted Rule



- The various standards for stationary engines are *very difficult and time consuming* to navigate.
- Different standards and requirements apply based on:
 - engine type
 - purpose
 - date of manufacture
 - date of installation
 - power output
 - displacement per cylinder
 - whether lean burn or rich burn (if spark ignition)

- **Subpart III stipulates that 40 CFR 80 “Regulation of Fuels and Fuel Additives” must be referred to in order to find diesel fuel requirements for certain engines.**

Furthermore:

- **Subpart III requires that the owner or operator of certain engines must comply with emission standards for their engine that apply to the engine manufacturer.**
- **For some of these engines, the applicable emission standards are found in 40 CFR 89 “Control of Emissions from New and In-Use Nonroad Compression-Ignition Engines” Subpart B and are given in units of grams per kilowatt-hour.**

- **40 CFR 63 Subpart ZZZZ “National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines” (the RICE rule) directs certain newer engines to comply with either:**
 - **40 CFR 60 Subpart III “Standards of Performance for Stationary Compression Ignition Internal Combustion Engines” (diesel fuel engines), or**
 - **40 CFR 60 Subpart JJJ “Standards of Performance for Stationary Spark Ignition Internal Combustion Engines” (gasoline, natural gas, and LPG engines).**

However

- These are **not absolute standards**, but only apply to emissions as measured using specific procedures to determine a “weighted cycle average.”
- These procedures for emissions of
 - nitrogen oxides (NO_x),
 - carbon monoxide (CO),
 - hydrocarbons (HC), and
 - non-methane hydrocarbons (NMHC)are given in 40 CFR 89 Subpart E, which consists of 23 sections and two appendices.

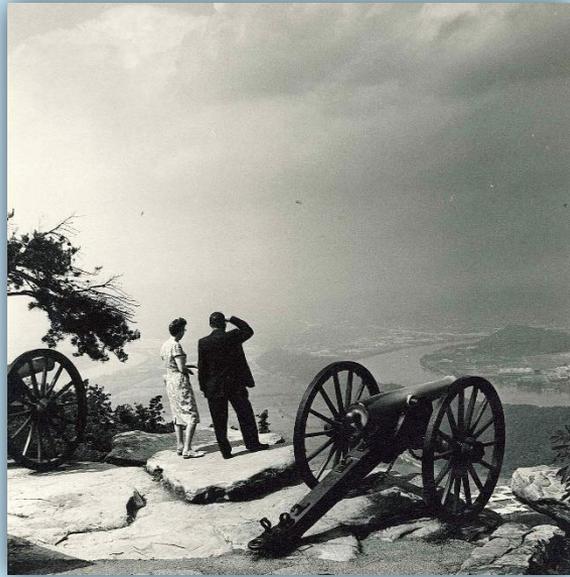
- **Appendix B lists four different test cycles that could apply to an engine, and these cycles consist of up to eight testing modes, each with a different required:**
 - **engine speed**
 - **observed torque or power**
 - **minimum time in the mode**
 - **weighting factor.**

- **These procedures for emissions of particulate matter are given in “California Air Resources Board Test Procedure,” which is referenced in 40 CFR 89 Subpart A.**
- **Although this document is not available online, the subpart notes that it may be obtained by mail or requested by phone.**
 - **Calling this number gives the following message:**

“Sorry, the mailbox is full and there is not enough space to leave a message.”

CHATTANOOGA, TENNESSEE

A Tale of Two Cities



Bob Colby, Director
Chattanooga-Hamilton County Air Pollution Control Bureau



Tennessee River-Gorge (Wikimedia Commons)

Chattanooga, Tennessee “Scenic City”

Chattanooga is known as the “**Scenic City**,” and for good reason. Nestled within the Tennessee mountains, alongside the beautiful Tennessee River, the views here are truly breathtaking.

It was voted “**Best Town Ever**” by *Outside* magazine, and named as one of the South’s top travel destinations.

Just a Few Accolades:

- ***NEW YORK TIMES*** - one of the “**Top 45 Places to go in the World**”
- ***CNN TRAVEL*** - a “**regional gem**” and “**Scenic City USA**” with “literally dozens of attractions packed along the city’s downtown riverfront.”
- ***LONELY PLANET*** - “**Best in the U.S.**” and “**10 U.S. destinations you need to see in 2018**”
- ***VAGABONDISH*** - “The downtown area is hip, fun, & vibrates with the energy of a city on a serious upswing. Outside the city, **there’s a lifetime worth of outdoor experiences to keep any adventure-loving traveler happy.**”
- ***The Washington Post*** - ***You’re going where? Chattanooga – A Tennessee city firmly rooted in the past keeps moving on with new music in historical buildings, vintage guitars in a modern museum and a river’s unchanging beauty running through it. (A monthly series highlighting the best vacation destinations you’ve probably never considered.) Sept. 2017***

Accolades (Cont.)

- **READERS DIGEST** – “America’s Most Interesting Towns” and “Most Interesting Scenic View”
- **SMART MEETINGS** - “...the ‘Scenic City’ has experienced an astonishing transformation during the last 20 years and now glistens with fresh paint, high rises and a serious collection of performing arts and attractions”
- **PREVUE** – “Chattanooga’s industrial Choo-Choo days are long gone” and now “Chattanooga is clean and extreme.”
- **NEW YORK TIMES** – “Despite some transformative growing pains, the city may well be one of the most pleasant and livable ones in the United States.” *Jan. 11, 2018*
- **TRAVELOCITY – APRIL 2018** – “...Chattanooga is absolutely one of the best small city road trip destinations in the country.”

Chattanooga Has a Dirty Past.....



The Beginning of Industrialization



- In 1816, John Ross, later Principal Chief of the Cherokee Indians, established a trading post, Ross's Landing, one mile north of here, on the banks of the Tennessee River's turbulent waters. In 1839, the City of Chattanooga was incorporated in the area John Ross had established. A black mark in our nation's history is that the Cherokee Nation was forcibly removed by Federal troops in 1838 and 1839 at the direction of President Andrew Jackson in violation of a U.S. Supreme Court order. The "Trail of Tears" removal of the Cherokee Nation to what is now Oklahoma resulted in the death of nearly one quarter of the Cherokees.



- The "iron horse" arrived in 1850 ending Chattanooga's isolation and converted it into a focal point for commerce.

The Post-Civil War South

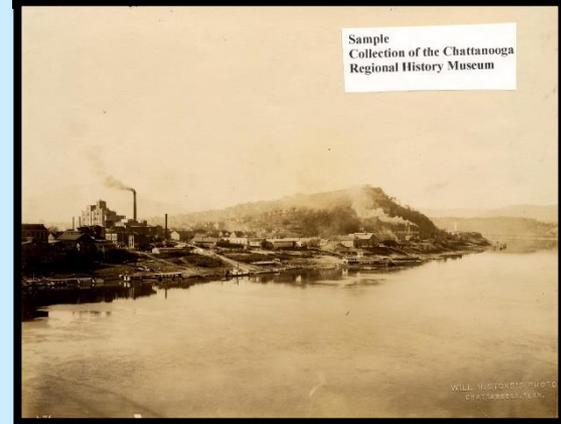
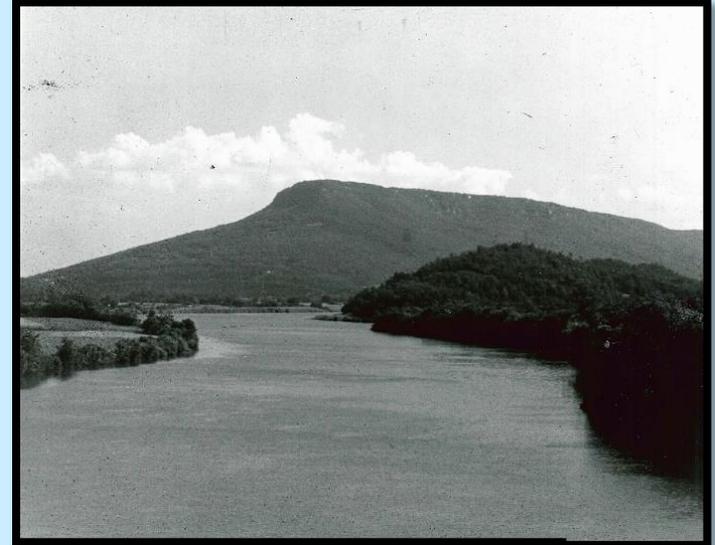
After the Civil War, many Southern leaders advocated economic reconciliation with the North and industrial development as the keys to a better future. The attraction of capital and industry from the North and foreign countries became a continuing pursuit, and the South became, as some have put it, "industrially articulate." Inspired by promoters like Henry W. Grady of Atlanta, the concept of a "New South" with a balanced economy of agriculture and industry became a regional crusade.

Post-Civil War Industrialization

After the Civil War, Chattanooga became a center for the agents of northern financiers who were investing in the area hoping to exploit iron deposits and virgin timber or to take advantage of tax breaks and other subsidies being offered to lure industry to the "New South." Within 5 years after the end of the war, Chattanooga had 58 industrial operations, including iron works, furniture factories, sawmills, gristmills, and other factories. During this decade capital investment in the city increased by nearly 450 percent. Within 20 years, Chattanooga was an iron-making center. We had 9 furnaces with 17 foundries and machine shops and were considered the iron-making capital of the South.

Prosperity . . .

- Chattanooga's abundance of natural resources, such as coal and a powerful river, attracted all kinds of industries, large and small
- Beginning in the 1930's, TVA constructed dams in the area for flood control and hydroelectric power which supplied inexpensive electricity for industry.
- Continued development brought Chattanooga to the per capita ranking of 8th in the nation for industry in 1974.



. . . and Pollution

- But the economic success also brought smokestacks pumping black smoke from the burning of soft coal into the air
- In fact, many thought billowing smokestacks represented economic success



Pollution Deaths Get World-Wide Attention

- **Disasters occur in London, New York, Los Angeles, and New Orleans**
- **Donora, Pennsylvania – Oct. 1948**
 - **Approximately 6,000 people sick**
 - **20 people died**
- **These disasters heightened awareness of the need for change.**

POLLUTED AIR SICKENED 6,000

**Report on 20 Smog
Fatalities Released**

WASHINGTON, Oct. 14 (AP)—Polluted air, pinned motionless by unusual weather, turned a creeping fog into a weapon of death at Donora, Pa., a year ago.

That conclusion was reached by the public health service in a 200-page report released last night. It followed many months of investigation by a team of 25 scientists.

The soot-laden fog, or smog, snuffed out 20 lives and made 6,000 persons ill. It began Oct. 27, 1948.

It sickened 15 per cent of the dogs in town—and killed 10 of them, three cats, 250 chickens and some pet rabbits and canaries. It didn't seem to bother cattle, sheep, horses or pigs.

"Our scientists tell us it was a rare phenomenon," said Federal Security Administrator Oscar R. Ewing.

"We hope and pray it will never recur—and it need not, if recommen-

dations made by industrial hygiene engineers in this report are carried out."

Ewing added that he will ask Congress for \$250,000 to carry on efforts to prevent air pollution.

The report recommended that cities and heavy industries take steps to reduce sharply the amount of smoke and grime their chimneys and exhaust pipes belch into the air.

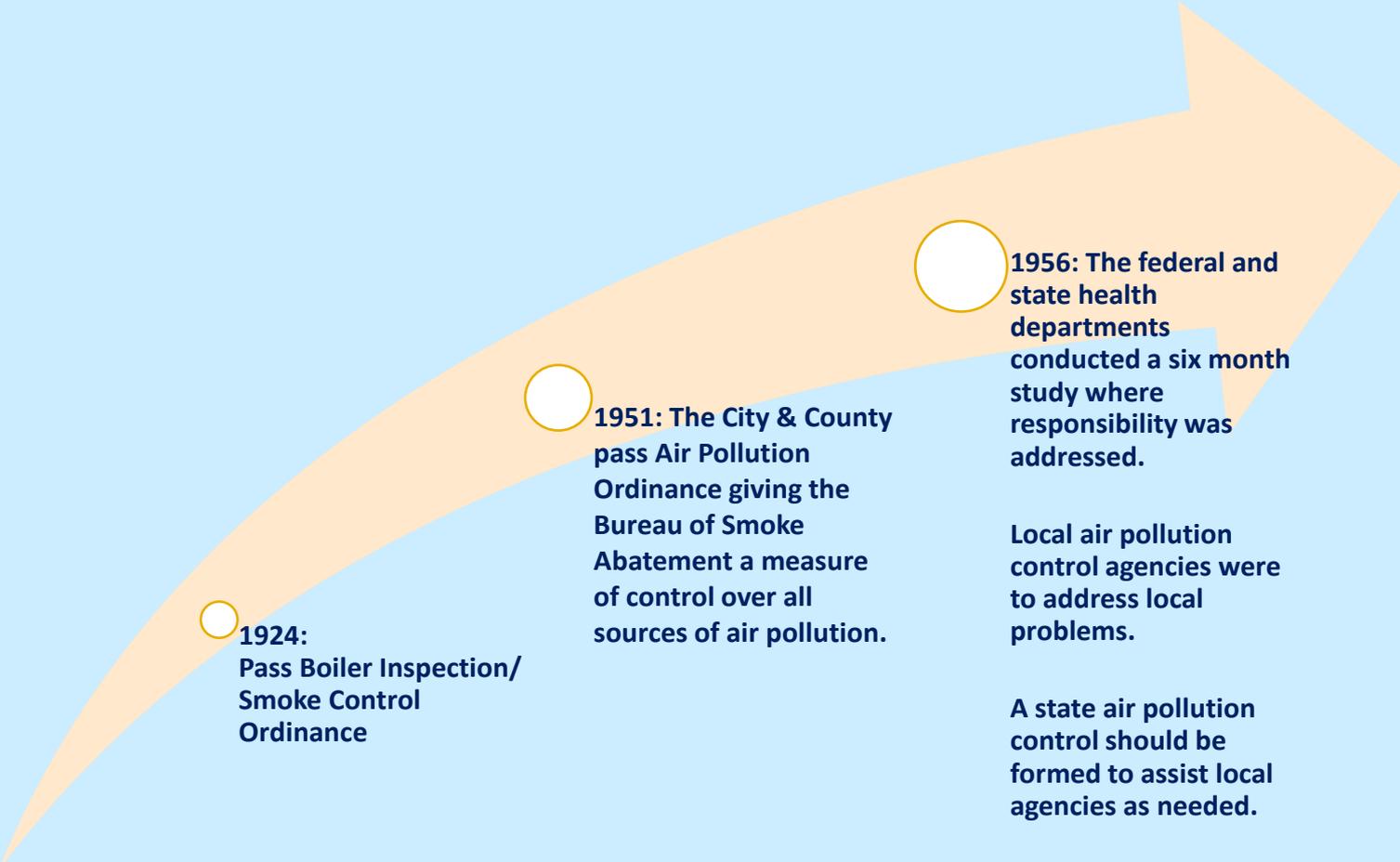
It said the weather bureau should broadcast an alert when an "anticyclone"—like that which hovered over Donora—approaches smoke-blanketed valleys of eastern states. An anticyclone is a system of moderate winds revolving clockwise about a dead center.

The alert should be followed, it said by a "warning to take preventative measures" when the anti cyclone actually enters the industrial area and conditions are right for fog to form.

Finally, the report said, industries and cities should be required to observe the warning by curtailing smoke-producing activity or, if necessary, closing plants and buildings entirely.



The Long Struggle to Control Air Pollution

A large, light orange arrow pointing from the bottom-left towards the top-right, serving as a timeline for the historical events.

1924:
Pass Boiler Inspection/
Smoke Control
Ordinance

1951: The City & County
pass Air Pollution
Ordinance giving the
Bureau of Smoke
Abatement a measure
of control over all
sources of air pollution.

1956: The federal and
state health
departments
conducted a six month
study where
responsibility was
addressed.

Local air pollution
control agencies were
to address local
problems.

A state air pollution
control should be
formed to assist local
agencies as needed.

What Was Causing All of This Pollution?



Boilers



Vehicles



Unregulated Burning



Railroads



Foundries and Other Industry

Topographical & Meteorological Struggles



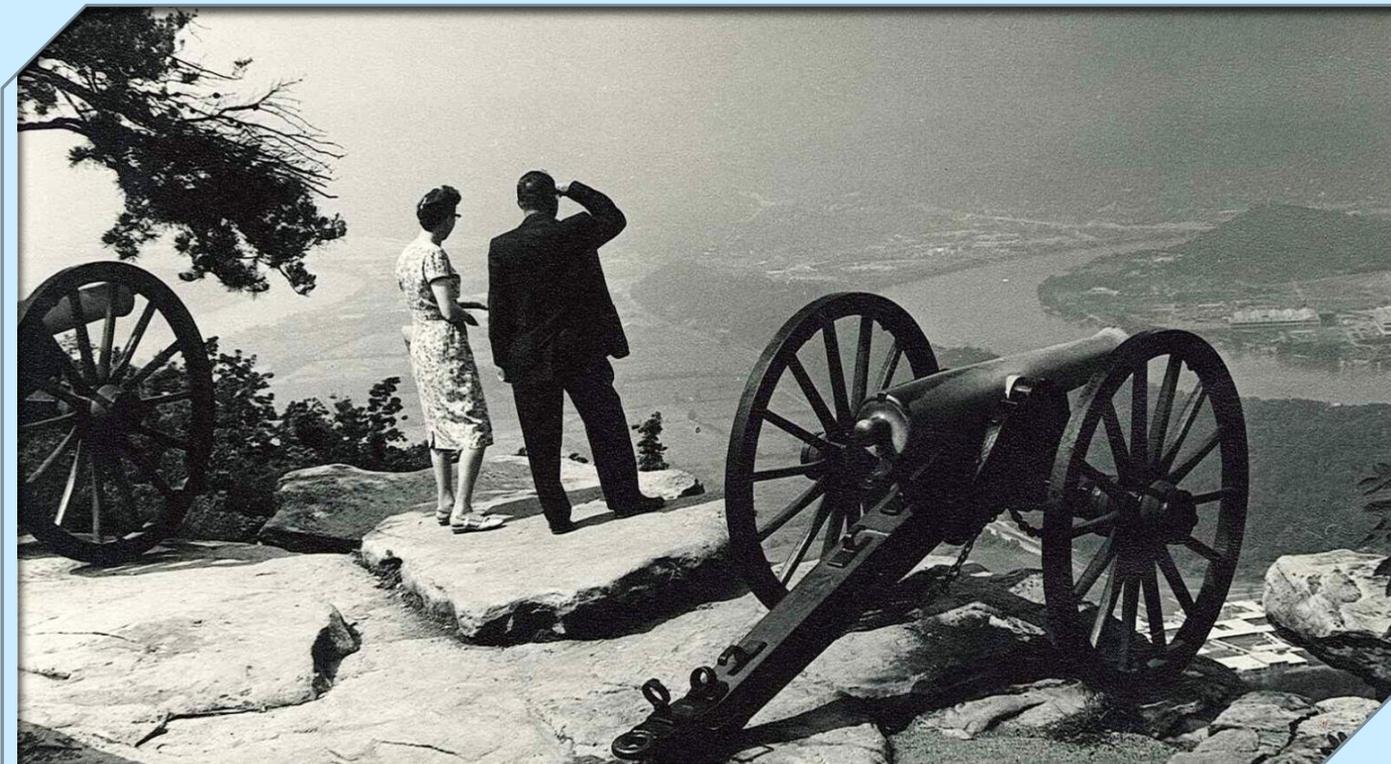
- **Temperature Inversions:** Warm air from the mountains traps cool air from the valley holding air pollution within the city like steam within a lidded pot.
- **Annual Average Inversions:** Chattanooga experiences approximately 175 days each year of thermal inversions. Warm air from the mountains traps cool air from the valley holding air pollution within the city like steam within a lidded pot.
- **Low Wind Speed:** Chattanooga's average wind speed is 6.6 mph. Wind speeds of 35 mph are needed to intermix the inversion.

People drove with their headlights on in the middle of the day.



The Original Regional Haze Program





**You couldn't "See 7 States."
It was difficult to even see one!**

Women's **stockings disintegrated** when they walked outside and men brought an extra **white shirt** because the one they wore to work would be **gray**.



More Reasons for Concern

1957-1961:

A United States Public Health Survey ranks Chattanooga as the 3rd worst city in nation for particle pollution.

1963:

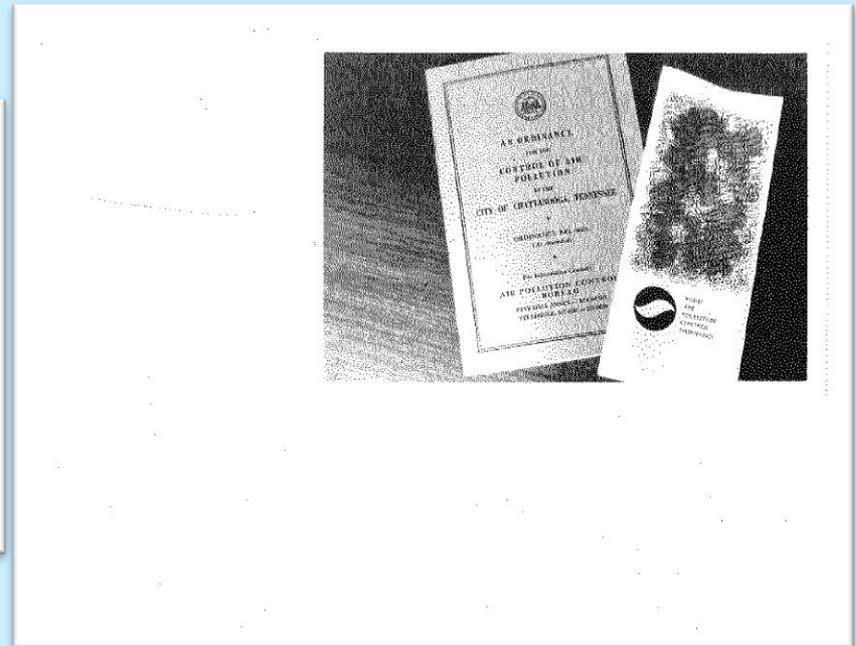
The Hamilton County mortality rate from tuberculosis was *3 times* the national average and *double* the Tennessee rate. It was thought by some to be linked to air pollution.

1967:

Concerned citizens reach out to officials for help. Chattanooga Mayor, Ralph Kelley asked the HEW to conduct the first clean air study for Chattanooga.

The Clean Up Begins in Earnest

Hamilton County and its 10 municipalities pass the newly approved *Chattanooga-Hamilton County Air Pollution Control Regulations* in 1969.



New Rules

- Open burning allowed by permit only
- Regulated odors and dust
- Outlawed visible emissions
- Set a 4% cap on sulfur content in fuel
- Controlled the production of sulfur oxides
- Limits on industry's visible emissions
 - Thickness of smoke emissions to be evaluated by Ringelmann number system
 - **October 14, 1972:** Deadline for all existing major sources of air pollution to be in compliance with a specified (Ringelmann #2) opacity level of smoke emissions.

Remarkable Clean-up

Every major pollution source in Hamilton County met the 1972 compliance deadline at an estimated expense of \$40 million!

On October 13, 1972 Chattanooga industries started their new pollution control equipment together, marking the beginning of
“clean air, a new pride, and a sense of real accomplishment for Chattanooga.”

Chattanooga Celebrates with Clean Air Week

October 20-26, 1972



Clean-up Brings National Attention



“This city was known as the most polluted city in the nation. Now Chattanooga is rated as one of the cleanest cities.” – *U.S. News and World Report*

National Air Pollution Control Association awards Chattanooga 1st place in their *Annual Cleaner Air Week* ceremonies recognizing their pollution control progress.

Chattanooga is the only city in the nation to be awarded the **Quality of Life Award** in the category of air pollution abatement by air-conscious magazine, *The Environment*.

“WHEN A CITY OF WHICH INDUSTRY IS POLLUTING, SUCH A GREAT PART CAN TURN THINGS AROUND, AS CHATTANOOGA HAS APPARENTLY DONE IN THE PAST 5 YEARS, IT DOES REPRESENT A TRULY HERCULEAN EFFORT.”

TOM McCall – OREGON GOVERNOR



EPA Determines that the
1977 Air Quality Standards
Are Not Stringent Enough
to Protect Human Health

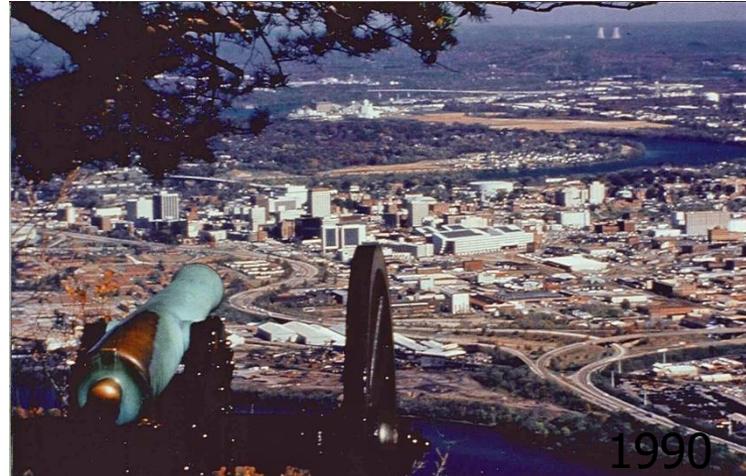
Meeting the Ozone Standards



**Chattanooga met the *Federal Ozone Standard* on
December 13, 1989**

Ozone Attainment

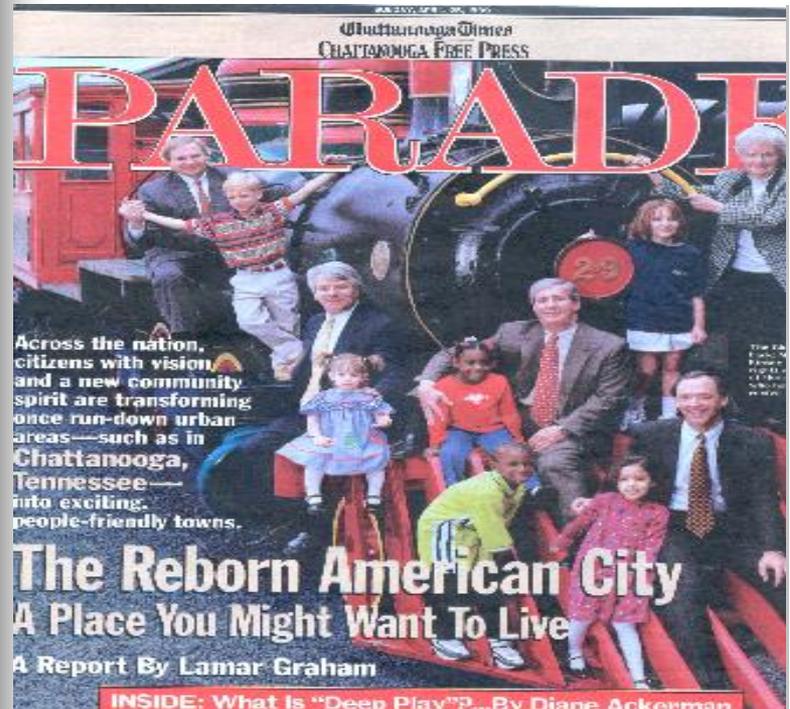
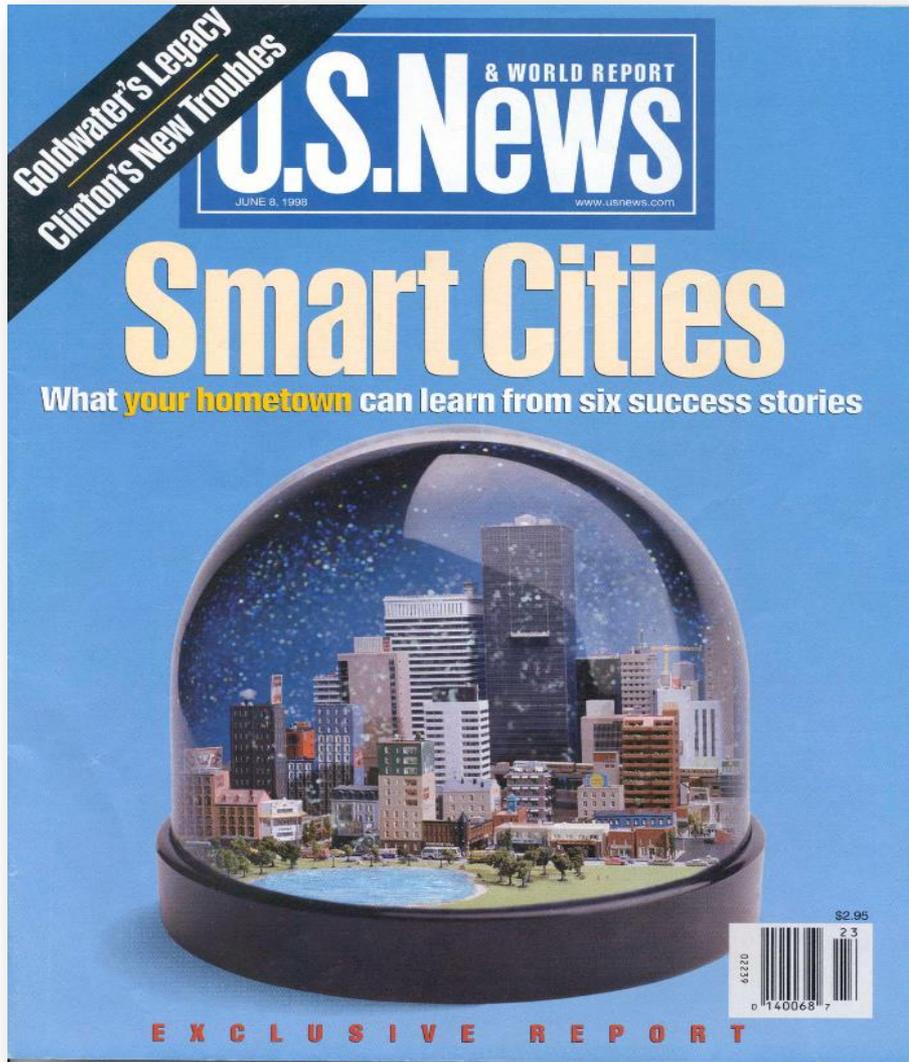
Chattanooga Meets All Federal Air Pollution Health-Based Standards for 1st Time in 1989



“Twenty years ago Chattanooga was one of the worst offenders in the nation in terms of its air pollution levels . . . Today, in contrast, the City is in compliance with EPA primary standards for particulates. ***Certainly you have come a long way, and your progress can serve as a model for other communities faced with similar problems.***”

— Lee Thomas, EPA Administrator, Dec. 1989

Chattanooga Gets National Press





Chattanooga's "Can Do" Message Spurs Broader Environmental Movement in the Community

Clean-Up Encourages the Revitalization of The “Scenic City”

- **Goal: Create a “sustainable community” where both people and nature can prosper**
 - Tennessee Aquarium served as catalyst for change
 - Rebuild the Riverfront and provide public spaces and events for people to help eliminate social, racial, and economic barriers which existed
 - Electric buses (one of the largest fleets in the world)
 - Expansion of greenways
 - Redevelopment of the Southside and brownfield sites
 - Rebuild neighborhoods to improve socio-economic conditions and quality of life
 - The “Chattanooga Way”

Tennessee Aquarium and Riverfront





Greenways & Walking Trails



Air Quality Standards Revised

Standard

Timeframe

□ Ozone

125 parts per billion **1977** (1-hour standard)

▶ *85 parts per billion 1997 (8-hour standard)* ◀

75 parts per billion **2008** (8-hour standard)

70 parts per billion **2015** (8-hour standard)

□ Particulate Matter

<i>Daily</i>	<i>Annual</i>	<i>Year</i>
260 $\mu\text{g}/\text{m}^3$	75 $\mu\text{g}/\text{m}^3$	1971 (TSP)
150 $\mu\text{g}/\text{m}^3$	75 $\mu\text{g}/\text{m}^3$	1971 (TSP secondary standard)
150 $\mu\text{g}/\text{m}^3$	50 $\mu\text{g}/\text{m}^3$	1987 (PM ₁₀)
65 $\mu\text{g}/\text{m}^3$	15 $\mu\text{g}/\text{m}^3$	1997 (PM _{2.5})
35 $\mu\text{g}/\text{m}^3$	15 $\mu\text{g}/\text{m}^3$	2006 (PM _{2.5})
35 $\mu\text{g}/\text{m}^3$	12 $\mu\text{g}/\text{m}^3$	2012 (PM _{2.5})

What Did This Mean for Chattanooga?

- **Compliance Deadline**
- **Chattanooga's air was cleaner than ever, but:**
 - current pollution levels were too high.
 - drastic measures would need to be taken to comply with the new standards.
 - 2000 - Ozone
 - 2002 - Particulate Matter
- **Failing to meet the standards could mean the imposition of *federal sanctions*.**
 - Loss of federal funding for the APCB
 - Restrictions automatically imposed on expansion of new and existing industry

Early Action Compact

Developing a plan for
compliance

Call to Action

EPA determines national standards for various air pollutants

Communities measure to see if they meet

Communities develop pollution reduction plans for failing pollutants

Plans submitted to state as part of the State Implementation Plan (SIP) to achieve standards

EPA accepts SIP or returns for revamping

Early Action Compact: Advantages and Requirements

- EPA will defer the effective date of non-attainment status until December 31, 2007
- Attainment designations will be based upon monitoring data from 2005 through 2007
- If a designated milestone in the EAC area is not met, the non-attainment designation will become effective for that area
- Must implement local measures specified in local plan submitted to EPA in December 2004

Early Action Compact: Advantages and Requirements (Continued)

- **No non-attainment New Source Review**
 - i.e. less restrictive rules for new and expanding industry
- **No requirement to offset new emissions from expansions or relocations**
- **No transportation conformity required**
 - To ensure continued federal highway funding, must show that emissions from vehicle traffic will not increase

Measures Adopted

All measures were implemented by 2005

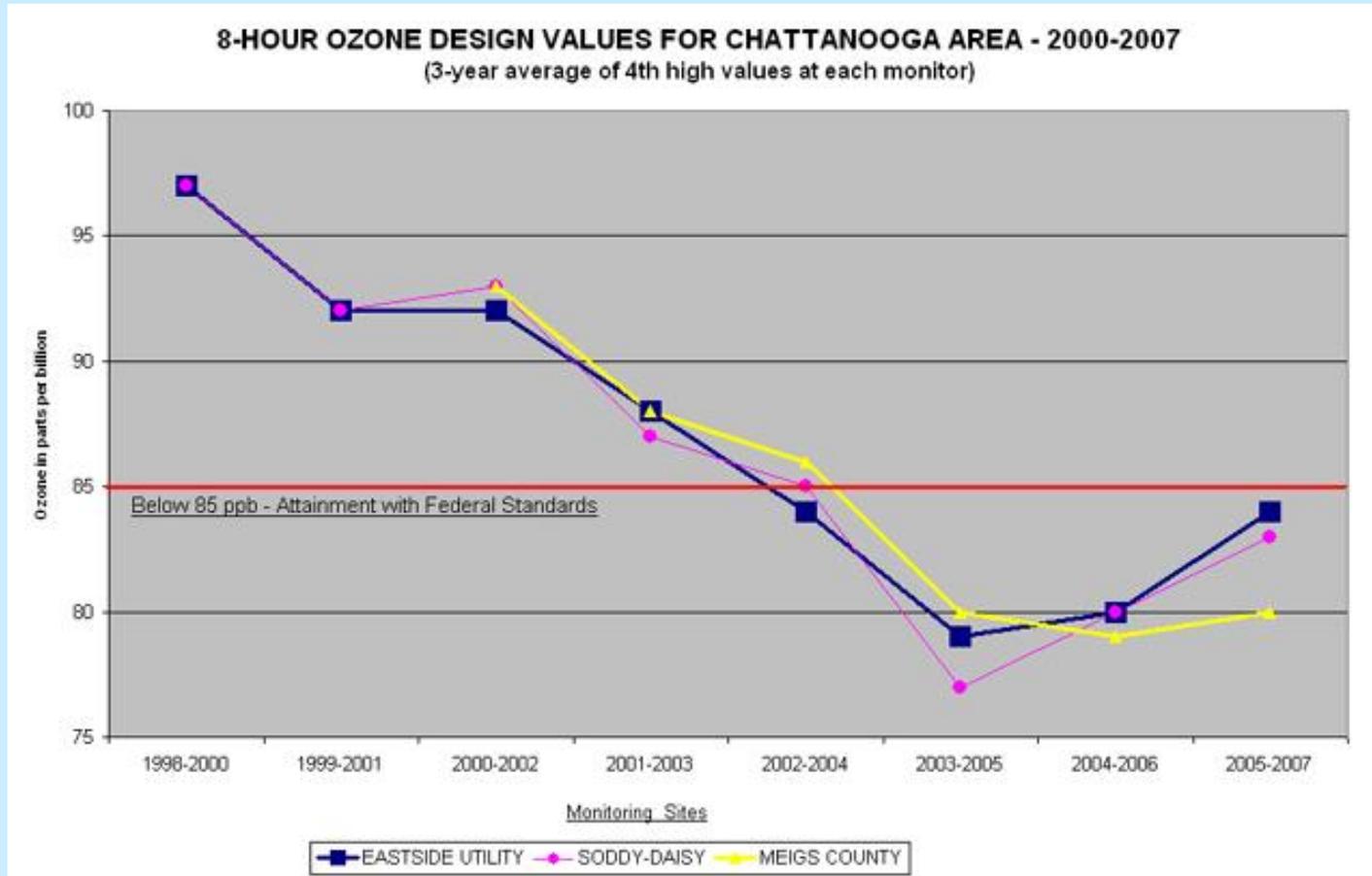


- Ozone Season Burning Ban
- Stage 1 Vapor Recovery
- Automobile Inspections
- Reduced Truck Speed Limits
- Ozone/PM2.5 Alert Program (*Pollution Solution* Action Days)
- School Bus Diesel Retrofit



Chattanooga Does It Again

2008 – Designated in attainment for ozone



"Attainment" Brings New Industry

Just **3 months** after being designated as in attainment of the ozone standard, Volkswagen chose Chattanooga as the location to build their new North American vehicle assembly plant.

VOLKSWAGEN
GROUP OF AMERICA



Media Information

FOR IMMEDIATE RELEASE

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Volkswagen Group of America Announces It Will Produce Cars in Chattanooga; Decision Marks Company's Ongoing Commitment to North American Market

Company will invest \$1 billion and bring about 2,000 direct jobs to tri-state area

HERNDON, Va. (July 15, 2008) — Volkswagen Group of America, Inc. announced today that it will build a U.S. automotive production facility in Chattanooga, Tenn., where it will produce a car designed specifically for the North American consumer and invest \$1 billion in the economy. The announcement is an important element of the company's overall U.S. strategy of connecting with its customers, increasing its competitiveness and tripling its U.S. customer base in the next decade.

"The U.S. market is an important part of our volume strategy and we are now very resolutely accessing that market," said Prof. Martin Winterkorn, CEO of Volkswagen AG. "Volkswagen will be extremely active there. This plant represents a milestone in Volkswagen's growth strategy. We will be selling 800,000 Volkswagens in the U.S. by 2018, and this new site will play a key role. This, along with our growth strategy, is a prerequisite for the economic success of the company in the dollar region. We look forward to establishing an important mainstay for ourselves when we become the biggest European carmaker there."

"This is a significant step forward in achieving our goals in the U.S. market and a clear sign of the Volkswagen Group's commitment to the North American consumer. Today's decision is a fundamental part of our new strategic direction in the U.S. and our five-pillar strategy," said Stefan Jacoby, President and CEO of Volkswagen Group of America. "Chattanooga is an excellent fit for the Volkswagen culture, having an exceptional quality of life and a long manufacturing tradition."

The company will build the facility in the Enterprise South Industrial Park, located 12 miles northeast of downtown Chattanooga. The 1,350-acre site is 100 percent owned by the city of Chattanooga and Hamilton County and is certified as an industrial megasite by the Tennessee Valley Authority. Enterprise South is adjacent to Interstate 75. Initial production capacity for the facility is anticipated to be 150,000 vehicles, including a new midsize sedan



Had we not had the Early Action Compact and its measures which were implemented, we would not have had Volkswagen.

2008 - EPA Lowers the Air Quality Standards Again

Later that year, just as Hamilton County met the tightened federal standard requirements, the EPA again decided that the regulations were not stringent enough to reduce pollution-related illnesses, and lowered the standard again.

Ozone – 2008 Standard

<u>Standard</u>	<u>Timeframe</u>
125 parts per billion	1977 (1-hour standard)
85 parts per billion	1997 (8-hour standard)
<u>75 parts per billion</u>	<u>2008 (8-hour standard)</u>

Chattanooga's Ozone Design Value in 2007
was 84 parts per billion.

Long Way to Go . . . but On the Right Track

- This meant:

- **Hamilton County was once again out of "attainment".**

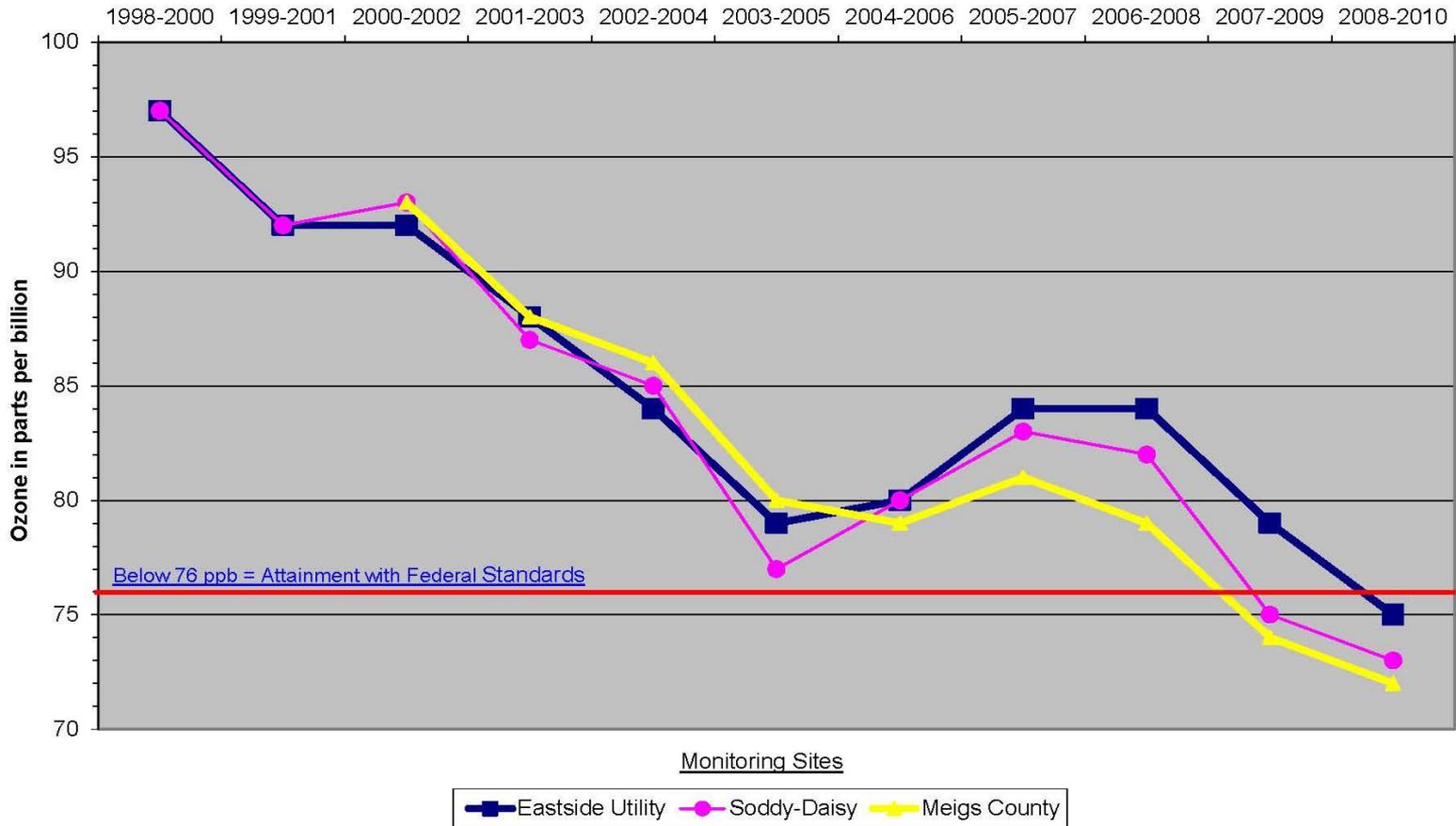
- This time, with several air pollution control measures already in place from the Early Action Compact from 2004-2005, **Hamilton County was moving in the right direction.**

- EPA also was requiring cleaner motor vehicles and fuels, so vehicle emissions would be reduced over time as older vehicles would be replaced with newer ones.

- These measures helped Hamilton County to improved air quality even more.

2010 – Healthful Air Once Again

8-Hour Ozone Design Values for Hamilton County, Tennessee - 2000-2010
(3-year average of 4th high values at each monitor)



Air Quality Standards Revised

Standard

Timeframe

□ Ozone

125 parts per billion **1977** (1-hour standard)

85 parts per billion **1997** (8-hour standard)

75 parts per billion **2008** (8-hour standard)

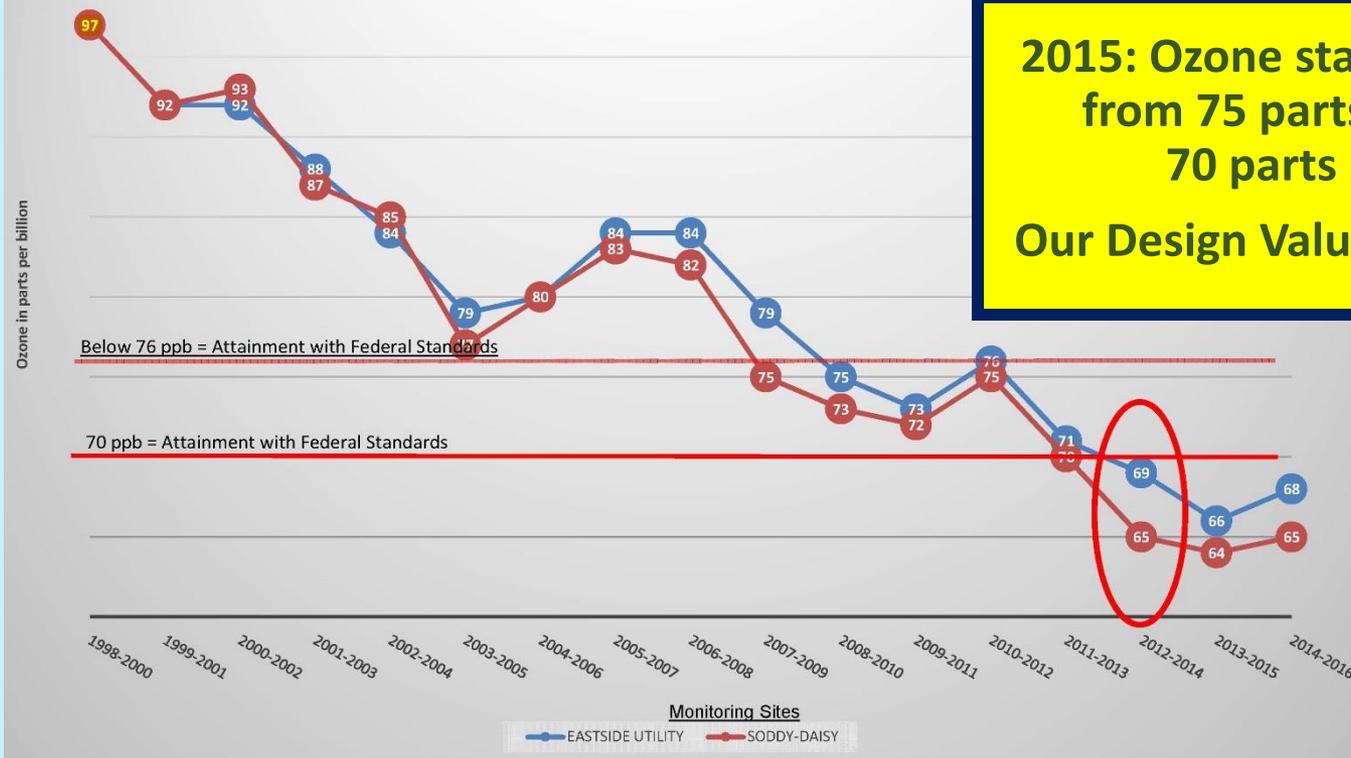
▶ **70** parts per billion **2015** (8-hour standard) ◀

□ Particulate Matter

	<i>Daily</i>	<i>Annual</i>	<i>Year</i>
	260 µg/m ³	75 µg/m ³	1971 (TSP)
	150 µg/m ³	75 µg/m ³	1971 (TSP secondary standard)
	150 µg/m ³	50 µg/m ³	1987 (PM ₁₀)
	65 µg/m ³	15 µg/m ³	1997 (PM _{2.5})
	35 µg/m ³	15 µg/m ³	2006 (PM _{2.5})
	35 µg/m ³	12 µg/m ³	2012 (PM _{2.5})

Protecting Human Health Means Lower Ozone Standards

8-HOUR OZONE DESIGN VALUES FOR CHATTANOOGA AREA - 2000-2015
(3-year average of 4th high values at each monitor)



2015: Ozone standard is lowered from 75 parts per billion to 70 parts per billion.
Our Design Value was 69 in 2014!



Without the cooperation among government, industry and concerned citizens, the progress Chattanooga has made would not have been possible.